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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/599,894

03/08/2007

David Mainwaring

21854-00075-US1

6101

30678

7590

02/11/2008

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EXAMINER

DUNLAP, JONATHAN M

ART UNIT

PAPER NUMBER

2855

MAIL DATE

DELIVERY MODE

02/11/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/599,894	Applicant(s) MAINWARING ET AL.	
	Examiner JONATHAN DUNLAP	Art Unit 2855	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 December 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. **Claims 3-6** are rejected under 35 U.S.C. 102(b) as being anticipated by **Terai et al. (NPL – Properties of carbon films produced from polyimide by high-energy ion irradiation)** and **Fink et al. (Conductivity of Aged Non-Overlapping and Overlapping Tracks in Ion Irradiated Polyimide)**.

Considering claim 3, Terai discloses a method of forming a strain sensor from a polymeric film which includes the steps of:

- Selectively irradiating a surface of the polymer with high energy radiation to change the composition of the polymer (**Abstract**); and
- Increase the electrical conductivity in selected portions of the surface (**Figure 5; Introduction; Experimental; Results and discussion, page 630, paragraph 1**).

Terai fails to mention that the claimed fluence is adequate to form strain dependent electrical properties.

3. However, Fink discloses that the electrical properties of the carbon-polyimide film are dependent upon the spacing between the gaps in the carbon particles. Specifically, as the gap between the carbon particles, in a film that is below its percolated point, is elongated, the electrical conductivity decreases (**Abstract, Page 52, Conductivity of Single Nuclear Tracks, Conductivity of Overlapping Tracks**). Therefore, under uniaxial strain in a direction perpendicular to the direction of the irradiated tracks, a carbon-polyimide film, which is irradiated to a point below its percolated point, will experience an elongation in the gap between carbon particles, which effectively decreases the conductivity of the film. The invention by Terai specifically discloses that the polyimide films at a fluence of around 7×10^{13} ions/cm² begin to experience a decrease in surface resistance. Therefore, it would be required that polyimide films, which have been irradiated with a fluence of less than 1×10^{15} ions/cm² would have strain dependent electrical properties.

Considering claim 4, Terai discloses that the high energy radiation carbonizes the polymer to form conductive particles in the polymer (**Abstract, Introduction**).

Considering claim 5, Terai discloses that high energy ions impinge on a polymer film containing precursor metal compounds, such that decomposition of the precursor leads to nucleation of conducting metal particles (**Introduction; Page 629 (paragraph continued from page 628; Figure 2)**).

Considering claim 6, Terai discloses that the polymer is a polyimide (**Introduction**).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. **Claims 1-3 and 7-8** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Terai et al. (NPL – Properties of carbon films produced from polyimide by high-energy ion irradiation)** and **Fink et al. (Conductivity of Aged Non-Overlapping and Overlapping Tracks in Ion Irradiated Polyimide)** in view of **Bureau et al. (U.S. Patent 5,437,195)**.

Considering claim 1, Terai discloses a specimen which consists of a polymer that has been irradiated with less than 1×10^{15} ions/cm² in a portion of its surface (**Abstract; Introduction; Experimental; Page 631; Column 1**).

Terai fails to mention that the claimed fluence is adequate to form strain dependent electrical properties.

5. However, Fink discloses that the electrical properties of the carbon-polyimide film are dependent upon the spacing between the gaps in the carbon particles. Specifically, as the gap between the carbon particles, in a film that is below its percolated point, is elongated, the electrical conductivity decreases (**Abstract, Page 52, Conductivity of Single Nuclear Tracks, Conductivity of Overlapping Tracks**). Therefore, under uniaxial strain in a direction perpendicular to the direction of the irradiated tracks, a carbon-polyimide film, which is irradiated to a point below its percolated point, will experience an elongation in the gap between carbon particles, which effectively

decreases the conductivity of the film. The invention by Terai specifically discloses that the polyimide films at a fluence of around 7×10^{13} ions/cm² begin to experience a decrease in surface resistance. Therefore, it would be required that polyimide films, which have been irradiated with a fluence of less than 1×10^{15} ions/cm² would have strain dependent electrical properties.

The invention by Terai fails to explicitly disclose that the specimen is used as a strain sensor and that conductive tracks are deposited onto the treated portion to enable the sensor to be connected to an external electric circuit.

6. However, Bureau teaches a polymer strain sensor, which has been irradiated with ions and conductive tracks are deposited onto the treated portion to enable the sensor to be connected to an external electric circuit (**Figure 1-2; Column 3, lines 23-61**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the polymer specimen irradiated by ions as a strain sensor as taught by Bureau. The motivation for doing so is that by using a polymer strain sensor, the premature fatigue and varying characteristics of temperature that are associated with prior art polymer sensor which have metal layered on top of the polymer can be avoided (**Column 1, lines 24-61**). Furthermore, by irradiating conductive tracks right into the film, the need for additional layers or conductive tracks, i.e. additional metal, which would reintroduce the problems associated with the prior art, is also avoided.

Considering claim 2, Terai discloses that the polymer is a polyimide film
(Introduction).

Considering claim 7, Terai fails to disclose that conducting tracks are deposited onto the treated polymer to enable the device to be connected to an external electric circuit.

7. However, Bureau teaches that the conducting tracks are deposited onto the treated polymer to enable the device to be connected to an external electric circuit
(Column 3, lines 35-49).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit conductive tracks into the treated polymer film as taught by Bureau. The motivation for doing so is that by using a polymer strain sensor, the premature fatigue and varying characteristics of temperature that are associated with prior art polymer sensor which have metal layered on top of the polymer can be avoided **(Column 1, lines 24-61)**. Furthermore, by irradiating conductive tracks right into the film, the need for additional layers or conductive tracks, i.e. additional metal, which would reintroduce the problems associated with the prior art, is also avoided.

Considering claim 8, Terai fails to explicitly disclose that a strain sensor is made using the irradiated polymer film.

8. However, Bureau teaches a polymer strain sensor, which has been irradiated with ions **(Figure 1-2; Column 3, lines 23-61)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the polymer specimen irradiated by ions as a strain sensor as taught by Bureau. The motivation for doing so is that by using a polymer strain sensor, the premature fatigue and varying characteristics of temperature that are associated with prior art polymer sensor which have metal layered on top of the polymer can be avoided (**Column 1, lines 24-61**).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Lin et al. (**Npl – Preparation and Properties of Conductive Polyimide Films**) teaches that the carbon gap distance influence the conductivity of film.

Svorcik et al. (**Npl - Degradation of Polyimide by Implantation with Ar⁺ Ions**) teaches that fluences between 5×10^{14} and 5×10^{15} cause a rapid change in sheet resistance before the saturation (percolation threshold) at 5×10^{15} .

Response to Arguments

Applicant's arguments, see Amendment, filed December 17, 2007, with respect to the rejection(s) of claim(s) 1-8 under 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of **Fink et al.**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Dunlap whose telephone number is (571)270-1335. The examiner can normally be reached on M-F 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz can be reached on (571) 272-2180. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edward Lefkowitz/

Supervisory Patent Examiner, Art Unit 2855

/J. D./
Examiner, Art Unit 2855
February 5, 2008